
## CMWR 2008 STUDENT FELLOW AWARDEE


| | |
|---|---|
| **Name:** | Milos Vasin |
| **Institution:** | Institute of Hydraulic Engineering, University of Stuttgart, Germany |
| **Email address** | Milos.Vasin@iws.uni-stuttgart.de |


**TITLE: Influence of soil structure on estimation of effective parameters in the unsaturated zone**


***ABSTRACT***

Heterogeneity of the soil parameters effects flow in the unsaturated zone. When the flow in the unsaturated zone is modelled, the heterogeneity can not be resolved in detail. Therefore, simplified (upscaled) models have to be derived, which allow us to handle the complexity of the processes, but still capture the influence of the heterogeneities as far as possible. The main goal of this study was to assess the potential of predicting flow with an upscaled models and to analyse influence of the structure on the effective model parameters. To this end, multi-step drainage experiments in two heterogeneously packed sand columns (10x10x20 cm3) have been performed. Two different packing structures were generated using sand cubes of 1x1x1 cm3 of two different sand types. The heterogeneous structures of the columns can be considered as two opposing extremes. The first column was packed with a random arrangement of the two sand types with a column-spanning connected cluster for both materials. The second column was packed with a periodic pattern of coarse sand inclusions in a fine sand background, having a clearly defined unit cell. Beside the outflow, the depth averaged (2D) spatial distribution of the water content in the columns was monitored during the whole multi-step outflow experiment using neutron radiography. 3D water content was measured at steady state by neutron tomography. The experimental results are compared to model predictions of an upscaled model derived with homogenization theory. Effective parameters for upscaled models were first derived with a set of parameters predicted from the pore scale structure of the two individual sand types. The predictions with these parameters will be discussed in the talk in order to assess the potential of predicting soil parameters from pore scale properties. Additionally, the hydraulic parameters of both sands were identified by fitting the model predictions to the measured outflow curves. The different column structures showed a significant effect on water retention and the effective retention function, as water was trapped in the coarse-sand inclusions of the periodic structure. We included this effect of trapping in the effective retention function of the upscaled model with an apparent air entry pressure. Contrary to the retention, the different packing structures had no large effect on the dynamic behaviour of outflow. The upscaled models predicted the movement of the averaged water content in the two columns well, also in the randomly packed column where the assumptions made for the upscaled model are not strictly met.